

IN THE CLAIMS:

1. (Currently Amended) A reversible physiological process for temporal separation of oxygen evolution to avoid deactivation of hydrogenase in the presence of oxygen and sustain photosynthetic hydrogen production in cells of an algae microorganism, comprising:

(a) growing a culture of cells of algae microorganism photoheterotrophically in a Tris-acetate-phosphate medium under ~~illuminated~~ white fluorescence illumination conditions to accumulate an endogenous substrate;

(b) depleting a nutrient selected from the group consisting of sulfur, iron, and/or manganese from the medium in the presence of DCMU by suspending said culture of cells in the absence of said nutrient and sealing until the culture of cells of algae microorganism from atmospheric oxygen until conditions become becomes anaerobic and sealing the culture from atmospheric oxygen;

(c) measuring the rate of cellular oxidative respiration in m mol O₂ (mol Chl)⁻¹s⁻¹ of a sample of cells of said suspended ~~of the~~ algae microorganism from step (b) in the dark until it is constant or about 13 m mol O₂ (mol chl)⁻¹s⁻¹ with an O₂ electrode;

(d) ~~incubating~~ measuring the rate of O₂ evolution of a sample of the algae microorganism from step (c) ~~in~~ under light of saturating intensity of yellow actinic excitation at about 1,300 μm photons m⁻² s⁻², and measuring the light-saturated rate of O₂ evolution with an O₂ electrode;

(e) inducing reversible hydrogenase through photosynthesis by controlling the light saturated rate of oxygen production from the culture of cells of algae microorganism of step (b) so that it is equal to or less than a the constant or 13 μ mol O₂ (mol Chl)⁻¹s⁻¹ rate

of cellular oxidative respiration using saturating blue actinic excitation at 250 μ mol photons $\text{m}^{-2}\text{s}^{-1}$ at 700 nm ~~rate of cellular oxidative respiration [; and~~

~~(f) collecting]~~ to generate an evolved gas that includes hydrogen.

2. (Previously Amended) The process of claim 1 wherein said hydrogen is generated from water and the accumulated endogenous substrate.

3. (Original) The process of claim 1 wherein depleting is to a concentration of 0.5 millimolar or less.

4. (Cancelled)

5. (Original) The process of claim 1 further comprising, after incubating and collecting, repeating the steps of growing to accumulate additional substrate, depleting, sealing and incubating for a plurality of cycles.

6. (Currently Amended) The process of claim 2 wherein the microorganism is selected from the group consisting of a green, red, brown, and blue-green algae.

7. (Original) The process of claim 2 further comprising providing the medium with the depleted nutrient after generating, and repeating the steps of growing, depleting, incubating and generating.

8. (Original) The process of claim 2 wherein the substrate is selected from the group consisting of acetate, carbohydrate, lipid and protein.

9. (Cancelled)

10. (Original) The process of claim 6 wherein the algae is *Chlamydomonas reinhardtii*.